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RECENT CHANGES IN ENGINEERING MANPOWER REQUIREMENTS AND SUPPLIES IN CANADA



A professional manpower bulletin

ECONOMICS AND RESEARCH BRANCH
DEPARTMENT OF LABOUR
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Recent Changes in
ENGINEERING MANPOWER REQUIREMENTS AND SUPPLIES
in Canada

Professional Manpower Bulletin No. 4

ECONOMICS AND RESEARCH BRANCH
DEPARTMENT OF LABOUR, OTTAWA
January, 1959

Hon. Michael Starr
Minister

A.H. Brown
Deputy Minister



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Introduction

The purpose of this bulletin is to bring up to date the information appearing in two previous reports * issued by the Department of Labour on the current and prospective demand and supply situation for engineers.

The labour market for engineering manpower in Canada has been affected by two important developments during the past twelve to eighteen months. First, a slackening of economic activity occurred throughout 1957 and into 1958, after several years of sustained expansion. Although this trend was reversed around the middle of 1958, previous peaks have not yet been reached in most phases of the economy's operations. Second, there was a very large volume of immigration of engineers in 1957. Even when the increased number of engineers emigrating to the United States in that year is taken into consideration, the net immigration of engineers to Canada during 1957 was very much a record.

Since the two reports referred to earlier were released new data have become available, permitting a re-assessment of the general demand and supply situation. Another in the series of biennial surveys of requirements for engineering and scientific manpower, regularly conducted by the Department of Labour, has been completed. The results of this survey are helpful in determining changes in the actual number of engineers employed from the end of 1956 to the end of 1957. They also provide forecasts of expected engineering employment at the end of 1958, 1959 and 1960. In addition, the survey provides some information on the extent of recruitment difficulties experienced by Canadian employers in hiring engineers over recent years.

The results of another survey are also now available. In the spring of 1958 engineering and science students in the final year of their undergraduate studies at Canadian colleges and universities were surveyed to obtain some indication of their future plans. These students were asked if they were going back to university, or had found employment, or were looking for jobs to take on graduation, or had other plans. Since this information was obtained for the first time, it is not possible to assess changes in the intentions and employment situation of university graduates from one year to another. It does, however, reveal the situation as it stood in the spring of 1958.

In order to complete the analysis of supply and demand for engineers in Canada, information from other sources has been used, such as ratios of job vacancies for engineers (reported to the National Employment Service) to engineering applicants registered, and the number of job openings for new university graduates reported in a survey made annually by the National Employment Service since 1951. There is also a review

* *Skilled and Professional Manpower in Canada, 1945-1965*, a report of the Royal Commission on Canada's Economic Prospects, July 1957, 104 pp. "Trends in Professional Manpower Supplies and Requirements", Bulletin No. 1, Professional Manpower Bulletin Series, August 1957, 30 pp.

of the trend from 1952 to 1958 in the weekly earnings of workers as a whole as compared with starting salaries for engineers, and a discussion of various aspects of engineering manpower utilization.

This analysis has been prepared in the Manpower Resources Division of the Economics and Research Branch by Dr. P.H. Casselman under the direction of Mr. J.P. Francis.

The Situation in Perspective

In this section available information on engineering manpower supplies and requirements will be summarized and co-ordinated in an effort to answer three major questions: Has there been a shortage of engineers in recent years? What is the current labour market situation regarding engineers? What is the outlook?

The Recent Past

The excess of job openings for both newly graduated and experienced engineers, over qualified applicants for jobs, reported by Canadian employers both through special surveys and to the National Employment Service; the extent of recruitment difficulties reported by Canadian employers, and the rapid increase in engineering salaries as compared with earnings of workers as a whole, all indicate that there was a considerable shortage of engineers prior to 1958. This shortage became widespread in 1955, reached its peak in 1956, and slackened off in 1957. In stating that an engineering shortage did exist in Canada during that period, no consideration is given to what the situation might have been if a greater number of competent technicians had been available or if this or that other condition had been met.

Briefly, the major reasons for the shortage of engineers were that while the demand for such personnel was increasing with unusual speed as a result of record economic expansion, the new supply of engineers on the other hand was declining because of a decreasing number of engineering graduates from Canadian universities and colleges and a simultaneous drop in the net immigration of engineers.

The Current Situation

What is the current labour market situation for engineers? Is there still a shortage, a surplus, or are supply and demand fairly well in balance?

In 1957, two major changes occurred which radically modified the engineering labour market. About the middle of the year, Canada's economy started to show signs of a recession and consequently of a drop in the demand for engineers. At the same time, the new supply of engineers increased because of a rise in university graduations and in net immigration, with the latter factor being by far the more important as far as current changes in new supplies were concerned.

The year 1958 saw a continuation of the 1957 labour market situation for engineers. Canada's economy did not expand at the 1956 rate, thus keeping the rate of increase in the demand for engineers below that year's figures. At the same time, the new supply almost reached the 1956 level. However, the most noticeable change on the supply side of the picture in 1958 as compared with 1957 concerned immigration. The net immigration of engineers in 1958 was considerably lower than the record level of the previous year.

The Department of Labour's 1958 Survey of Requirements for Professional Personnel revealed that universities expected to hire approximately the same number of engineers in 1958 as in 1957, while government agencies expected their needs to rise considerably. The combined requirements for engineers by universities and governments, however, fell far short of offsetting the decline from 1957 to 1958 in the rate of increase expected on the part of industrial employers.

National Employment Service statistics relating engineering vacancies to applicants, and statistics on the number of reported job openings for new graduates in 1958, indicated a major decline in the demand for engineers as compared with 1957 and 1956. The trend of starting salaries of engineers, which reflected only a slight annual increase in 1958 as compared with the relatively larger increases of previous years, pointed in the same direction.

In answer to the specific question as to what the labour market situation is for engineers in 1958 and early 1959, it can be stated that generally demand and supply are fairly well in balance but with a tendency towards a surplus particularly of new and inexperienced engineers. Some shortages have persisted but they are mainly local and specialized in character resulting from the inability to match the available applicants with the specific job requirements and at the rate of pay offered. The present situation no longer indicates a general deficiency of supply as compared with the demand although universities and governments still report considerable difficulty in recruiting the engineers they need. In their case the lower salary scales as compared with those in industry probably constitute the main problem.

The Outlook

Some of the factors that will influence the labour market for engineers over the next few years can be predicted with considerable accuracy, while others are virtually impossible to anticipate.

On the supply side, the number of engineering graduates from Canadian universities will increase steadily for at least the next three or four years, approaching 3,000 in 1962 as compared with 2,000 in 1958. The prospective immigrant contribution is less predictable because it depends on future government policy, on the economic situation in Canada, and on general conditions prevailing in the countries supplying the immigrants. Keeping in mind, however, the generally expanding need for engineers and highly trained technical workers in all countries, a reasonable assumption would seem to be that the immigration of engineers to Canada would not vary a great deal from the 1,000 level reached in 1958. The emigration of Canadian engineers to the United States is likely to continue the moderate increase that has occurred over the last five years—the 1958 figure was 800. Net immigration, therefore, may well be negligible, perhaps moving from a gain of 200 to 300 in 1958 to a loss of a similar amount in two or three years.

The important change in the supply picture over the next few years will be a shift from a situation where net immigration was contributing almost as much to new supplies as were graduates of Canadian universities, to one where net immigration has fallen to negligible levels while graduations have increased considerably.

The future demand for engineers in Canada is, of course, related to the state of the economy, particularly the rate of investment and the character of the Canadian defence program. There are signs that economic activity in both the United States and Canada is now increasing. It is significant, however, that the rate of recovery so far has been quite moderate.

The experience of recent years has shown that the demand for engineers can change very markedly as the character and level of economic activity fluctuates. The build-up in Canadian defence activity after the Korean war and the unusually large private investment program which followed, both created a very large demand for highly trained people such as engineers. During 1957, when many of these activities reached a peak, the employment of engineers increased by approximately 10 per cent.

Over the next few years, there will probably be a significant change in the Canadian defence program as a shift is made from the design and production of Canadian aircraft to the purchase of United States missiles. At present, the moderate recovery of economic activity under way does not include a pick-up in private investment. The general result of these trends is that the expansion in the employment of engineers which has occurred in recent years will probably continue but at a much reduced rate.

The following data summarize the supply and demand situation for the periods 1955-57 and 1958-60:

	1955-57 (actual)	1958-60 (forecast)
Number of engineers graduating from Canadian universities	4,670 ¹	6,500 ⁴
Approximate net immigration	<u>3,285 ²</u>	<u>500 ⁵</u>
Total new supplies	7,955	7,000
Net requirements	10,000 <i>to</i> 12,000 ³	6,500 ⁵

It should be noted that the data shown for requirements represent the additional jobs available to engineers due to expansion in their employment. There would be many other positions open to new engineers because of deaths, retirements, and withdrawals from the labour force for other reasons.

These data would suggest that a generally balanced labour market situation for engineers will continue to prevail in the immediate future. As indicated above, however, any sharp expansion in economic activity, particularly if accompanied by a rise in private investment, might create a shortage situation again very quickly.

¹ Higher Education Section, Education Division, D.B.S.
² Based on immigration data from the Dept. of Citizenship and Immigration, and emigration data from the United States Dept. of Justice.
³ Estimates based on results of 1958 Biennial Survey of Requirements for Professional Personnel, Dept. of Labour.
⁴ Based on engineering enrolment with allowance for drop-outs, original source: Higher Education Section, Education Division, D.B.S.
⁵ Dept. of Labour estimate.

The Changing Supply of Engineers

Graduate Engineers

There will be a gradual build-up over the coming years in the number of engineers graduating from Canadian colleges and universities. Three factors will be responsible for this increasing supply: an increase in the Canadian population of college age resulting from the higher birth rates of the Second World War, a rise in the number of young people going to university, and an increase in the number of university students taking engineering.

It is estimated that the number of persons of college age in Canada (age 18–21), both men and women, amounted to 894,000 in 1955. By 1960 this group is expected to reach 1,007,000 and by 1965, 1,245,000*. Undergraduate enrolment at Canadian universities and colleges has risen steadily since the early 1950's. In the 1954–55 academic year there were 64,300 undergraduates enrolled in Canada; in 1957–58, 78,700. By the 1960–61 academic year, it is expected there will be 95,000 undergraduates enrolled in Canadian universities and colleges and by 1964–65, 126,500**. These increases, it is anticipated, will raise the proportion of young people (ages 18–21 years) who are attending university from 7.2 per cent in 1955 to 10.2 per cent in 1965.

Table 1 – First Degrees and Engineering Degrees Conferred by Universities and Colleges in Canada, 1951–58

Year	(a) Total First Degrees ³	(b) Engineering Degrees ³	% (b) of (a)
1951	15,654	2,427	15.5
1952	13,288	1,770	13.3
1953	12,575	1,337	10.6
1954	12,083	1,252	10.4
1955	12,290	1,314	10.7
1956	12,800 ¹	1,585	12.4
1957	13,400 ¹	1,735	13.0
1958	14,200 ¹	2,000 ²	14.8

¹ Preliminary.

² Includes 1,806 who obtained engineering degrees in spring convocations and an estimate of those likely to obtain degrees in autumn convocations.

³ Higher Education Section, Education Division, D.B.S.

The increasing proportion of Canadian university students taking engineering is indicated in *Table 1*. An indication of a possible slackening in this upward trend, however, is indicated by recent data on first year engineering enrolment. These figures are shown in *Table 2*. For the first time since the decline in World War II veteran enrolment in the late 1940's, there was, in 1958–59, an actual drop from the previous

* "Skilled and Professional Manpower in Canada, 1945–65", report prepared by the Economics and Research Branch, Department of Labour, for the Royal Commission on Canada's Economic Prospects, p. 71.

** Ibid., p. 73.

year in the number of first year engineering students. This is probably linked to the reduction in job opportunities for engineers which occurred in 1958. If so, it illustrates the marked influence which the prevailing employment situation for engineers has on the decisions of those entering university as to the course they will take, at least as far as engineering is concerned.

Table 2 – First Year Enrolment in Engineering Courses¹
at Canadian Universities and Colleges

Academic Year	Number of Engineering Students
1945–55	3,245
1955–56	3,710
1956–57	4,516
1957–58	5,147
1958–59	4,762

¹ Includes a small number of general science students.
Source: Higher Education Section, Education Division,
D.B.S.

Another source of new engineers, numerically small but highly trained, are those Canadians who study for engineering degrees in the United States. In the 1955–56 academic year there were 759 such students in the United States; in 1956–57, 886; and in the academic year 1957–58, 958 Canadians were studying for engineering degrees in United States institutions. By far the greatest number of these students, from 80 to 90 per cent, are taking their first or under-graduate degree in the United States.

There are, however, two unknown characteristics about these students. It is not known how many graduate each year nor to what extent they return to Canada. As a result, only rough estimates of their contribution to the pool of engineering manpower in Canada can be made. The number estimated as being educated in the United States and having returned to Canada was 75 in 1956, 85 in 1957 and 100 in 1958. These figures are negligible for purposes of this analysis.

Immigration and Emigration

Figures on immigration of engineers into Canada, and on emigration of engineers from Canada to the United States, are given in Table 3 (for the years 1951 to 1958). As far as manpower supply is concerned what is most important to Canada is net immigration, i.e., the excess of immigration over emigration. From the table, it may be seen that both 1953 and 1954 were years of relatively high net immigration, namely 1,371 and 1,193 respectively. In 1955 and 1956, net immigration dropped considerably. In 1957, however, both immigration and emigration of engineers rose to reach the highest figures of the nine-year period under review. Immigration in this year exceeded emigration by a wide margin resulting in the largest net immigration of engineers into Canada in the 1951–1958 period.

Table 3 – Approximate Net Immigration of Engineers into Canada, 1951–58

Year	Immigration ³	Emigration ⁴	Approximate Net Immigration
1951	970	447	523
1952	1,466	538	928
1953	1,900	529	1,371
1954	1,687	494	1,193
1955	1,315	615	700
1956	1,700	953	747
1957	3,102	1,264	1,838
1958	1,000 ¹	800 ²	200 ²

¹ Based on actual immigration of 879 engineers for the first nine months of 1958.

² A rough estimate.

³ Department of Citizenship and Immigration.

⁴ United States Dept. of Justice.

What will the 1958 figures be? The only factor known at this date is the immigration of engineers into Canada during the first nine months of 1958 which totalled 879. Figures on emigration of Canadian engineers to the United States during even a part of 1958 will not be known for some months. It is roughly estimated that such emigration will total about 800 for the whole year. The basis for the possible reduction in emigration from the 1957 level is the economic recession in the United States, which during the earlier part of the year may have reduced the number of job opportunities there for Canadian engineers. However, later in 1958 the United States economy started to show signs of recovery. The cancellation of government contracts with one of Canada's largest aircraft manufacturers in the second half of the year resulted in the release of a good number of experienced Canadian engineers. It is known that a number of these have since emigrated to the United States and have obtained employment there. The end result of these various factors bearing upon the emigration of Canadian engineers in 1958 combined with the relatively small immigration of engineers to Canada this year could very well be a nil net immigration for the year or even a net loss.

Non-University Engineers

A number of engineering positions are filled in Canada by men who have not obtained an engineering degree from a university. Some of these receive recognition by successfully passing examinations set by the appropriate Canadian professional engineering body. Others have neither qualified academically as engineers nor are they recognized by an engineering association, but are considered as competent engineers at the professional level by their employers.

Only fragmentary information is available on the extent to which employers fill engineering jobs at the professional level with workers who have acquired their competency through work experience, periodic private study and informal learning. On the whole, they are an older group than the graduate engineers since they obtain their engineering status through years of informal training and experience. There are also probably a relatively large number of immigrants among them, including, for example, holders of Higher National Certificates from Great Britain.

There is some evidence that during a period of severe engineering shortages the number of non-graduate engineers increases since employers will intensify the practice of upgrading and perhaps even reduce their hiring standards. Firms that have to build up their production schedules relatively quickly may find the experienced non-graduate engineer more immediately useful to them than the recent college graduate who, although possibly possessing greater potential, has to be trained for several months before being able to make any valuable contribution to the production process. An adequate supply of graduate engineers would probably have the opposite effect, i.e., reduce the willingness of employers to promote the non-graduate into a professional engineering job except for those who are outstanding in ability or experience.

Table 4 gives an indication of the importance of the non-graduate engineers for five major engineering fields in Canada based on 1953 data from the Department of Labour's Register of Professional Personnel in Scientific and Technical Fields. A major observation may be made in connection with these figures. The figures as they stood in 1953 under-represent the proportion of non-graduate engineers by excluding those whose professional status as engineers is recognized solely by their employers.

Table 4 – Percentages of Engineers with and without University Degrees in Technical Personnel Register 1953, Canada

Type	Civil	Mechanical	Mining and Petroleum	Electrical	Chemical ¹
Non-Graduates	15.0	12.5	11.2	10.5	1.4
Obtained University Degree	85.0	87.5	88.8	89.5	98.6
Total	100.0	100.0	100.0	100.0	100.0

¹ Includes chemists.

Source: Register of Professional Personnel in Scientific and Technical Fields, Dept. of Labour, 1953.

On the recruitment side, an important new source of information has become available through the Department of Labour's Biennial Survey of Requirements for Professional Personnel just completed. In the survey, replies were received from a very large proportion of Canada's employers of engineering and scientific manpower. The questionnaire contained a section on recruitment sources including upgrading. Employers were asked to indicate in quantitative terms the extent to which workers were upgraded to professional work level during 1956 and 1957 and on what basis. The returns showed that 339 were upgraded to professional status during the period and of that number, 41 had obtained a university degree subsequent to their original employment, 240 were upgraded by recognition of their experience and ability and 58 by obtaining membership in a professional association. The two latter figures combined were equivalent to 9 per cent of the total hirings of engineers and scientists during 1956 and 1957 by the employers surveyed. It must be remembered in this connection that this was a period of considerable shortage of engineers.

Total New Supply

The two major sources of additions to the pool of engineering manpower, university graduates and net immigration, are shown in total in *Table 5*. From this table it may be seen that in 1958 graduates reached the highest number since 1951 while net immigration dropped to the lowest level of the nine-year period including 1951.

Table 5 — Supply of Engineers — Graduations and Net Immigration, 1951–58

Year	Total	Graduations ³	Approximate Net Immigration ⁴
1951.....	2,950	2,427	523
1952.....	2,698	1,770	928
1953.....	2,708	1,337	1,371
1954.....	2,445	1,252	1,193
1955.....	2,014	1,314	700
1956.....	2,407	1,660 ¹	747
1957.....	3,658	1,820 ¹	1,838
1958.....	2,300	2,100 ¹	200 ²

¹ Includes a number of Canadian graduates from United States institutions who returned to Canada, estimated to be 75 in 1956, 85 in 1957 and 100 in 1958.

² This is a preliminary estimate.

³ Higher Education Section, Education Division, D.B.S.

⁴ Results from immigration data from Dept. of Citizenship and Immigration, and emigration figures from United States Dept. of Justice.

Demand for Engineers

The overall demand for engineers is represented by the total number of engineering jobs in the country. Additional engineers are required to fill these jobs both as they expand in number and as vacancies are created because of deaths, retirements, transfers to other types of work, or withdrawals from the labour force. Some data are available on the net expansion of engineering jobs. Very little information is available on replacement needs.

Net Requirements for Engineers

Information on net requirements for engineers, limited to the needs arising out of expansion in the overall number of engineering jobs in the economy, is available from a biennial survey conducted by the Department of Labour. The latest of these surveys was conducted in the spring of 1958, and covered industry, government, and colleges and universities. These three kinds of employers were asked to estimate the number of engineers they expected to employ in different categories of professional engineering and scientific jobs.

Tables 6 and 7 give basic information on the actual and expected employment of engineers as reported by Canadian employers co-operating in this survey.

It could be seen from *Table 6* that for the three employment sectors as a whole, the employment of engineers rose by 10.1 per cent from the end of 1956 to December 31, 1957. However, expected increases are considerably lower, being reported as 6.9 per cent for 1958 over 1957 and slightly below 5 per cent for both 1959 over 1958 and 1960 over 1959. Industry, which employed over 80 per cent of the total engineers reported at the end of 1957, is mainly responsible for the decline in net requirements for engineers. Government agencies reported the smallest percentage increase in actual employment from December 31, 1956 to the same date in 1957, namely 7.1 per cent. Their expected net requirements, expressed in year to year percentage increases, follow an irregular pattern, from 15.2 per cent for 1958 over 1957 to a 3.0 per cent increase in 1960 over 1959. The universities and colleges, the smallest employers of engineers of the three sectors, increased their engineering employment by 11.1 per cent between the end of 1956 and the end of 1957 and expect year-to-year increases from 1958 to 1960 to go not much below that level.

In *Table 7*, the actual employment for 1956 and 1957 and expected employment in 1958, 1959 and 1960 are given for the major engineering fields for all three employer types combined. Insofar as the actual employment increases are concerned, metallurgical engineers showed the largest percentage increase, 13.6 per cent, and mining engineers the lowest, 6.1 per cent. All engineering fields are expected to show declining annual rates of increase from 1958 to 1960 as compared with the actual increase from 1956 to 1957.

Table 6 — Actual Employment of Engineers by Economic Sector, 1956 and 1957 and Expected Employment in 1958, 1959 and 1960 Reported by Canadian Employers in Survey 1958 (a)

Economic Sector	Actual Employment			Expected Employment					Forecast		
	(1) Dec. 31, 1956	(2) Dec. 31, 1957	% 2 over 1	(3) 1958	% 3 over 2	(4) 1959	% 4 over 3	(5) 1960	% 5 over 4	Average of % 1956-58 (b)	Average of % 1958-60
All Sectors	21,730	23,923	10.1	25,564	6.9	26,799	4.8	28,100	4.9	11.4	5.5
Industry	18,291	20,218	10.5	21,326	5.5	22,357	4.8	23,476	5.0	12.2	5.1
Universities.....	558	620	11.1	685	10.5	761	11.1	831	9.2	6.8	10.3
Government	2,881	3,085	7.1	3,553	15.2	3,681	3.6	3,793	3.0	7.7	7.2

(a) Source: Economics and Research Branch, Department of Labour, Biennial Survey of Requirements for Professional Personnel — 1958.
(b) Taken from the Department of Labour Biennial Survey of Requirements for Professional Personnel — 1956.

Table 7 — Actual Employment of Engineers by Field, 1956 and 1957 and Expected Employment, 1958, 1959 and 1960
as Reported by Canadian Employers in Survey — 1958 (a)

	Actual Employment			Expected Employment						Forecast	
	(1) Dec. 31, 1956	(2) Dec. 31, 1957	% 2 over 1	(3) 1958	% 3 over 2	(4) 1959	% 4 over 3	(5) 1960	% 5 over 4	% 1956-58 (b)	Average of % 1958-60
Aeronautical	298	325	9.1	356	9.5	356	0.0	367	3.1	11.4	4.2
Chemical	2,512	2,818	12.2	2,997	6.4	3,184	6.2	3,355	5.4	13.4	6.0
Civil.....	4,964	5,378	8.3	5,674	5.5	6,091	7.3	6,365	4.5	9.1	5.8
Electrical	5,841	6,356	8.8	6,845	7.7	7,041	2.9	7,314	3.9	9.5	4.8
Geological	310	349	12.6	362	3.7	373	3.0	391	4.8	13.4	3.8
Mechanical	5,969	6,687	12.0	7,230	8.1	7,565	4.6	8,044	6.3	17.4	6.3
Metallurgical	831	944	13.6	1,004	6.4	1,058	5.4	1,108	4.7	14.4	5.5
Mining	1,005	1,066	6.1	1,095	2.7	1,131	3.3	1,156	2.2	6.5	2.7

(a) Source: Economics and Research Branch, Department of Labour, Biennial Survey of Requirements for Professional Personnel — 1958.
(b) Taken from Department of Labour, Biennial Survey of Requirements for Professional Personnel — 1956.

In the last two columns of both *Tables 6 and 7*, three-year averages of expected increases in requirements for engineers are compared for two different periods. The average expected annual percentage increases from 1956 to 1958 were taken from the Survey of Requirements for Professional Personnel made by the Department of Labour in 1956 while 1958–1960 percentage increases were taken from the 1958 Survey.

Comparison of the two columns in both tables illustrates the great change which has taken place in employer expectations between the two surveys, particularly in the case of industrial employers. For example, in 1956, industry forecast an average percentage increase per year for 1956 to 1958 of 12.2 per cent while in 1958 employers in the same sector predicted an annual increase of 5.1 per cent for the period 1958–1960. However, in the case of universities and colleges, an increase in average annual requirements is forecast, from 6.8 per cent in 1956–1958 to 10.3 per cent in 1958–60, while for governments not much change is reported, 7.7 per cent for 1956–1958 and 7.2 per cent for 1958–60.

In the case of the individual engineering fields (*Table 7*), all reflect a considerable decline in expected net requirements between the two periods mainly because of the industrial employers' forecasts. In most cases, the expected increases for 1958–1960 are less than one-half the year-to-year increases forecast for the 1956–1958 period.

Recruitment Difficulties

In the same survey, employers were also asked to indicate whether they had experienced any recruitment difficulties in 1956 and 1957 and whether they expected any such difficulties in the three-year period from 1958 to 1960. Employers were asked a similar question in a previous survey two years ago covering the period 1954–1955. A comparison of the extent of recruitment difficulties for the three periods as reported by employers gives an indication of the changes which have taken place or are expected to take place in the labour market for engineers. The data appear in *Table 8*.

Table 8 – Recruitment Difficulties Reported by Employers of Professional Personnel in Canada, 1954–1955 and 1956–1957 and 1958–1960

Sector	Percentage of Employers Reporting Recruiting Difficulties, 1954–1955 ¹	Percentage of Employers Reporting Recruiting Difficulties, 1956–1957 ²	Percentage of Employers Expecting Recruiting Difficulties, 1958–1960 ²
All Sectors	N.A.	25	14
Industry	61	22	13
Colleges and Universities	90	75	61
Government Agencies	85	58	38

¹ Dept. of Labour: Biennial Survey of Requirements for Professional Personnel; 1956.

² Dept. of Labour: Biennial Survey of Requirements for Professional Personnel; 1958.

In the 1956 survey, 61 per cent of employers in industry, 90 per cent of the colleges and universities, and 85 per cent of government agencies, reported having recruitment difficulties in 1954 and 1955, as compared with 22 per cent, 75 per cent and 58 per cent respectively reporting recruitment difficulties in 1956 and 1957. As far as the outlook is concerned, a further decline in recruitment difficulties is expected by employers in all three sectors with only 13 per cent of industrial employers expecting recruitment difficulties, compared with 61 per cent for colleges and universities and 38 per cent for government agencies.

In the 1958 survey, Canadian employers gave details of their experience in expected recruitment difficulties by field of engineering. The results are summarized in *Table 9*. Analysis of this information shows that aeronautical engineering, followed by electrical, metallurgical and chemical engineering were the fields in which there were the greatest recruitment difficulties in 1956–1957, while mining, civil and geological engineering were the fields in which there was the least difficulty. As for expected recruitment difficulties from 1958 to 1960, three engineering fields stand far above the rest, namely aeronautical, electrical and metallurgical.

Table 9 – Difficulties in Recruiting Engineers in 1956–1957 and Expected for 1958 to 1960 by Field of Engineering

Field of Engineering	Percentage of Employers Reporting Having Had Recruiting Difficulties in 1956–1957 ¹	Percentage of Employers Expecting Recruiting Difficulties 1958–1960 ¹
Aeronautical	23	16
Chemical	17	7
Civil	12	7
Electrical	18	11
Geological	13	4
Mechanical.....	16	8
Metallurgical	18	12
Mining	12	5

¹ Dept. of Labour: Biennial Survey of Requirements for Professional Personnel; 1958.

A limitation relating to the use of these figures on recruitment difficulties must be kept in mind. The data given in *Tables 8* and *9* represent percentages of employers having experienced or expecting recruitment difficulties, with no indication given of the magnitude of the recruitment difficulties reported. For example, the recruitment difficulties reported by one employer may involve a few engineering specialists only while another employer's difficulties may be associated with the need for literally dozens of engineers.

Another clue to the changing labour market situation for engineers may be found by examining the statistics coming out of the operations and activities of the National Employment Service.

Since the end of the Second World War, the Executive and Professional Division of the National Employment Service has been functioning as a nationwide employment exchange for executive and professional personnel, including engineers. Every month detailed statistics are available on the regular operations of the National Employment Service and these figures include, among other data, the number of applicants and unfilled vacancies at a given date. These statistics are broken down by region and occupation with data for engineers shown separately. To help assess the current labour market situation for engineers by means of these data, average ratios of vacancies to applicants in the engineering field for each year from 1950 to 1958 have been worked out. (See Table 10).

Examination of the ratios shows that they range from 36 per cent in 1950 (or one vacancy for about three applicants) to 569 per cent in 1956 (or slightly more than five and a half jobs for every applicant), the second lowest ratio, 54 per cent, (or one vacancy for slightly more than two applicants) having been attained during 1958. On the basis of these figures, the period from 1955 to 1957, especially 1956, witnessed the greatest shortage of engineers of the nine years under review. Here again, the findings coincide with the conclusions arrived at from other sources.

The use of these ratios requires further comment and explanation. If all establishments that employ engineers were in only one location in Canada, and if all engineers were concentrated in the same location, and if any engineer could fill any engineering job, than a shortage of engineers would not develop until the ratio of vacancies to applicants exceeded 100 per cent. As it is, of course, both engineers and engineering jobs are strung out from coast to coast, and so vacancies may remain unfilled whenever the supply is not in the same area as the demand. Thus we may have a local shortage even when the total figures are in balance, i.e., a problem of geographic immobility. Another point is that a civil engineer, for instance, cannot fill an opening for a mechanical engineer, and a new graduate won't do if the company is looking for a man with long experience. A shortage, therefore, may exist when the ratio is well below 100 per cent.

These ratios exaggerate actual changes in the supply and demand situation because applicants have a greater incentive to register with the National Employment Service when jobs are scarce, while employers, in the same situation, are probably less inclined to register their vacancies, because they may fill them quite readily without any help from the placement service.

On the other hand, when applicants are scarce, many of them probably take jobs before they get around to registering, while employers probably resort to registering their vacancies to a much greater extent than they would in the normal course of events.

There are three major limitations in the use of these National Employment Service data. In the first place, the Service handles only a fraction of total professional placement work in any one year in Canada. Secondly, for reasons mentioned above, the National Employment Service figures probably over-estimate the changes in demand and supply. Thirdly, some of the applications for work on file with the Service do not represent persons out of work but engineers who are looking for better jobs. Notwithstanding these limitations, it is felt that these figures are reasonably meaningful in showing the general pattern of change in the labour market for engineers.

Openings for New University Graduates

Since 1951, the National Employment Service has been surveying the major employers of professional personnel in Canada in order to obtain from them an estimate of the openings they expect to have the following spring for new graduates in different fields, including engineering. Figures from this Survey are found in *Table 10*.

A review of these figures shows that for each year, except for 1951 and 1958, Canadian employers reported having more job openings for new graduates in engineering than the number of such graduates turned out by Canadian universities and colleges. The years 1956 and 1957 had the greatest number of job openings reported in excess of Canadians graduated from university in engineering.

Table 10 – National Employment Service Statistics on Labour Market Situation for Engineers, 1950–1958

Year	Vacancies as a Percentage of Applicants ¹	Openings for New Engineering Graduates	Number of New Engineering Graduates ⁴
1950	36	N.A.	3,600
1951	88	1,300	2,427
1952	73	2,300	1,770
1953	99	2,000	1,337
1954	83	1,900	1,252
1955	201	1,900	1,314
1956	569	3,100	1,660 ²
1957	202	3,800	1,820 ²
1958	54	1,390	2,100 ³

¹ Vacancies for engineers as a percentage of applicants at date closest to the first of the month. The figure for the year is the average of 12 months.
² Includes an estimate of Canadian graduates from United States' institutions who returned to Canada.
³ Includes an estimate of fall graduations.
⁴ Higher Education Section, Education Division, D.B.S.
 N.A.: Not available.

Future Plans of Graduating Students

In a survey of those in their final year of undergraduate study in engineering and science courses at Canadian universities and colleges made by the Department of Labour in the spring of 1958, students were asked to indicate their immediate future plans under four main headings: whether they planned to return to university, whether they were seeking work, whether they had already obtained employment, or whether they had other plans and what these were. Useful returns were received from 2,886 students, 1,677 in engineering, 1,113 in science and 96 in architecture. The total number of students graduating from these courses in 1958 was approximately 3,600.

The findings of this survey are summarized in *Table 11*. Of the 1,677 engineering students, 12.4 per cent reported they were going on for further study, 57.3 per cent reported having obtained employment, 27.5 per cent were still seeking employment, and 2.8 per cent had other plans. In the case of science graduates, 46.4 per cent reported planning to take further study, 22.4 per cent claimed to have found employment, 26.2 per cent were still seeking work and 4.8 per cent stated they have other plans.

Table 11 – Future Plans of Graduating Classes in Engineering and Science in Canada, 1958¹

	Further Study	Obtained Employment	Seeking Employment	Other Plans	Total	
	%	%	%	%	No.	%
Engineering Students.....	12.4	57.3	27.5	2.8	1,677	100.0
Science Students.....	46.4	22.4	26.5	4.8	1,113	100.0

¹ Dept. of Labour: Survey of Students in 1958 Graduating Classes in Scientific and Technical Fields in Canadian Universities and Colleges; Preliminary Release, September 1958.

In evaluating the above figures, one observation should be made. Of those who indicated they were seeking employment, it is possible that some of them had one or more job opportunities offered to them but that they were undecided as to which they would accept.

As mentioned earlier this survey was undertaken for the first time this year and consequently does not permit any year-to-year comparisons. However, the figures reveal the important fact that nearly 85 per cent of the engineering students who expected to obtain their Bachelor's degree in 1958 planned to enter the labour market immediately while only 48.9 per cent of the science graduating students planned to do so.

Trend of Weekly Earnings and Engineering Starting Salaries

It is generally assumed in labour market analysis that the trend of wages and salaries should reflect the changing relationship between supply and demand for the particular type of labour under study. In the section that follows, such an analysis is made of the situation in Canada for workers as a whole and for engineers.

In Table 12, the trends of weekly earnings for workers as a whole and of annual starting salaries for engineers are shown from 1952 to 1958, both in quantitative terms and in the form of indices. From these data it may be seen that increases in weekly earnings of workers as a whole and in engineering starting salaries followed each other very closely up to 1955. However, in 1955, 1956 and 1957 starting salaries for engineers rose at a much faster rate than industrial earnings. 1956 and 1957 were the two years when, as the preceding analysis indicates, Canadian employers experienced the greatest shortage of engineers since World War II. However, in 1958 starting salaries for engineers rose only slightly above the 1957 level while industrial earnings in general again increased significantly, thus confirming the relative slackening in demand for engineers which has been indicated by other sources of information reviewed in this bulletin.

Table 12 – The Trend of Weekly Industrial Earnings in Canada Compared with that of Starting Salaries of Engineers, 1952–1958

Year	Average Weekly Wages and Salaries ¹ at July 1		Annual Starting Salaries ² of Engineers	
	\$	Index	\$	Index
1952	53.96	100.0	3,370	100.0
1953	57.57	106.7	3,534	104.9
1954	58.98	109.3	3,775	112.0
1955	60.87	112.8	3,804	112.9
1956	64.56	119.6	4,266	126.6
1957	68.33	126.6	4,701	139.5
1958	70.63	130.9	4,740	140.7

¹ *Employment and Payrolls* – Dominion Bureau of Statistics. Industrial composite of the nine leading industries Monthly Average. Includes plant and office workers and all salaried employees.

² National Research Council, *Annual Survey of Professional Salaries*. Annual salaries paid as of July 1st.

Utilization of Engineers

One special aspect of the whole problem of supply and demand for engineering manpower, that of utilization, should be examined. Because of its nature and the comparative lack of statistical data on the subject, however, utilization has to be dealt with qualitatively and to some extent in theoretical terms.

In an effort to relieve the widespread shortages of engineers reported in recent years, considerable attention has been focused by employers and others on the problem of utilization of the engineer. One of the opinions often expressed is that many engineers in this country have not been utilized effectively, because some of the functions which they have been performing could have been done as well by competent technicians, if more of the latter had been available.

Apart from the employer's specific personnel policy on the matter, in practice the more or less efficient utilization of the engineer is determined by the supply and quality of technical assistants and by the relation between supply and demand for engineers during the specific period. Looking at the recent past (1955, 1956 and early 1957), the demand for engineers exceeded the supply while at the same time the supply of technicians was inadequate. The shortage of technicians probably accentuated the engineering shortage and many Canadian employers to meet their production schedules had no alternative but to utilize some of their engineers in lower grade work although paying them engineering salaries. Whenever demand exceeds the supply for a particular type of labour, over-staffing may also take place because employers may recruit beyond their immediate needs in order to have the manpower available in the future. This may have occurred, to some extent, in Canada during the period of greatest engineering shortages referred to previously.

In 1957, a great number of technicians (mainly from the United Kingdom) immigrated to this country. It is possible that this increased supply of technicians may have had some effect on the demand for engineers in the latter part of 1957 and in 1958, entirely apart from the other factors bearing upon the demand for engineers. It should also be pointed out that the number of graduates from technical institutions on the post-high school level in Canada is increasing. In a survey made by the Department of Labour in 1958 in co-operation with other government agencies, it was found that 677 "technicians" were graduated in 1952-53, 749 in 1954-55, 962 in 1955-56 and 1,027 in 1956-57.*

In future, if it becomes a general practice in Canada to intensify the use of the "technician" to perform the lower level engineering functions and other tasks previously performed by engineers, and if at the same time the plans for an increasing supply of technicians as a result of expanded training facilities for them continue to bear fruit, the demand outlook for engineers will be affected. As engineers are released from

*Report No. 5, Vocational Training Program in Canada. Table 2, page 67.

non-engineering tasks or from elemental engineering functions more appropriately performed by technicians, more of them will be available to meet the growing needs resulting from structural changes in Canada's industrial framework, and from technological progress and industrial expansion and growth.

What may happen to the utilization of engineers when their supply comes into balance with demand or when an actual surplus develops should be considered here. Employers finding it easier to obtain qualified engineers can afford to be more selective. They are in a position to hire and to retain on staff only the most efficient engineers for their engineering work. This in turn should result in a need for fewer engineers than would otherwise be the case. At the same time, still another result may occur when a fairly large surplus of engineers develops. The less efficient or less qualified engineer from the point of view of the employer, finding it more difficult to remain in or to obtain bona fide engineering employment, may, rather than join the ranks of the "out of work", accept jobs either without or with only a partial engineering content, thus leading to what could be considered to be "engineering underemployment" or "disguised engineering unemployment". A surplus of engineers in the labour market therefore may lead to contradictory results: the most qualified may be used more efficiently while the less able or less qualified may be used less efficiently. A surplus of technicians may also develop from this situation.

In connection with this problem of efficient utilization of the engineer, one could go even further and look at it from the human resources point of view. If only the most suited in aptitude and ability for engineering work became engineers, fewer of these would be needed because of their increased efficiency. This situation is unlikely to be realized fully. But it will continue to be important to work toward successful job orientation by providing vocational guidance information and financial assistance to those students who, although most suited for an engineering vocation and desirous of entering such a profession, cannot afford to do so.

